IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Dicken	Confirmation No. 9221
Application No.: 10/781,354	Attorney Docket No: 7390-X04-030
Filed: 02/17/2004	Group Art Unit: 2628
For: Method of Volume Visualization	Examiner: Hajnik

RESPONSE TO OFFICE ACTION

Mail Stop AF Response
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Examiner Hajnik:

In reply to the final Office Action mailed April 2, 2007, Applicant hereby submits the following remarks and requests for reconsideration. Applicant submits these remarks serve to clarify the present invention and are independent of patentability.

Reconsideration of the application is requested. Claims 1-3 and 6-18 remain in the application.

In item 2 of the Office action, the Examiner rejected claims 1-3 and 6-18 as being obvious over Gering in view of Gillick et al. '455 under 35 U.S.C. § 103(a). As will be explained below, the claims were patentable over the cited art in their original form and the claims have, therefore, not been amended to overcome the references.

Before discussing the prior art in detail, a brief review of the invention as claimed is provided. Claim 1 calls for, *inter alia*, a method of volume visualization that includes the following steps:

> providing of volumetric data, the volumetric data including a plurality of voxels defining a body structure and first voxels belonging to a reference surface, the reference surface being a surface of the body structure;
>
> entering a user selected distance by means of user interface means comprising a wheel mouse, an amount of rotation of the wheel of the wheel mouse being indicative of the user selected distance, the user selected distance measured from the surface of the body structure;
>
> determining of second voxels from the plurality of voxels of the volumetric data, wherein the second voxels are spaced the user selected distance from the reference surface, the second voxels belonging to the body structure; and
>
> visualizing of the second voxels in a 2-dimensional image, wherein the 2-dimensional image is located at the user selected distance from the surface of the body structure. (Emphasis added by Applicant.)

The object of the invention is to provide a method of volume visualization of volumetric data. The volumetric data includes a plurality of voxels defining a body structure with a reference surface. The method enables one to visualize a set out of these voxels that are spaced at a user-selected distance from the reference surface.

The method uses the surface (i.e first voxels) of an organ as a reference surface in order to visualize an inner layer (i.e. second voxels) of the organ that is parallel to the organ surface. The inner layer of the organ has a pre-selected distance from the reference surface. This allows for identification of suspicious regions, such as tumors near the surface. By simply rolling the wheel of a wheel computer mouse, the invention enables easy scrolling between multiple inner layers of the organ.

Subject Matter of Gering

Gering discloses a computerized surgical assistant that allows to fuse preoperative datasets and render them in an interactive 3D graphics environment (compare page 19). Volumetric data can be segmented semi-automatically. 3D surface models can be generated and visualized in a 3D view along with reformatted slices, and the slices can selectively clip away portions of some models, such as the skin, to reveal other unclipped models beneath, such as a tumor. Distances,

angles, surface areas and volumes of structures can be measured quantitatively (compare page 20, first paragraph).

Subject matter of Gillick et al. '455

Gillick et al. '455 relates to a computer mouse having a roller which implements a scrolling function for computer programs. Thereby, the object of the invention is to improve performance of Windows and similar operating systems and programs by simplifying and accelerating sub-functions performed by mice, in particular the scrolling function (compare abstract, column 2, lines 21-24).

Patentability of the current patent application over the prior art

The independent claims 1, 8, and 10 are not obvious over Gering in view of Gillick et al. '455 because the references fail to form a *prima facie* case of obviousness.

As already mentioned above, Gering discloses the visualization of a surface model along with reformatted slices, whereby it is possible to clip away portions of some models in order to reveal unclipped models beneath. In addition to the display of 3D views of surface models, Gering teaches to visualize slices that are visible in the 3D view and display them as cross-sections.

In contrast, the invention according to claim 1 relates to a method of volume visualization that includes providing of volumetric data: the volumetric data including first voxels belonging to a reference surface. Such a reference surface may be for example an organ surface. By entering a (i.e. one) user-selected distance by means of a wheel mouse, it is possible to visualize a two-dimensional image of voxels, wherein the voxels in the two-dimensional image are spaced at the given user-selected distance from the reference surface.

Using an organ surface as a reference surface for selecting voxels of the volumetric data that are equidistant to that reference surface allows visualizing an inner layer of the organ that is parallel to the organ surface in a two-dimensional image.

Therefore, the objective technical problem associated with Gering is how to enable a user to visualize an inner layer of an organ, the inner layer of the organ being parallel to the surface of the organ.

This problem is solved with the method as claimed in claim 1.

However, Gering is not able to meet the object of the instant application. For example, as described in section 1.3.1 of Gering, it is only possible to use two-dimensional views of a respective 3D view in terms of a cross-section that includes a cross-section of an anatomical image in grayscale, as well as cross-section of a volumetric form of a 3D surface model overlaid in color. However, as mentioned above, the object of the instant application is, not to provide a simple cross-section, but to provide a 2D projection of an inner layer of an object, with the inner layer of the object being parallel to the outer layer (reference surface) of the object with the reference surface not necessarily being planar. This is not possible at all using Gering.

On page 3 of the Office action of April 2, 2007, the Examiner argues that Gering teaches, "Determining of second voxels from the plurality of voxels of the volumetric data, wherein the second voxels are spaced to user-selected distance from the reference surface, the second voxels belonging to the body structure." The Examiner's argumentation is that, in Figs. 2-10, the second voxels are the volumetric data of the tumor and that the reference surface is the bottom surface on which the tumor lies.

However, the Applicant kindly disagrees with the Examiner. Claim 1 of the instant application state that the second voxels are spaced the user-selected distance from the reference surface. This implies that all second voxels have the same (i.e. an identical) selected distance (entered by means of a user interface means comprising a wheel mouse) from the reference surface. In contrast, in Figs. 2-10 of Gering, because the tumor is shown in three dimensions, the voxels of the volumetric data of the tumor do not possess only the common, identical pre-selected distance from the supposed reference surface upon which the tumor lies.

Furthermore, the Examiner applies the mentioned reference surface concept and distance to Figs. 1-3, whereby the Examiner mentions that the tumor data within the brain are the second voxels and the reference surface is associated with the skull. Thereby, the Examiner mentions further that the distance in these Figs. 1-3 is indicated by the amount of voxels removed from the outer skull to show the tumor.

Again, the Applicant kindly disagrees with the Examiner. In claim 1 it is clearly defined that the second voxels are spaced (i.e. one given) user-selected distance from the reference surface. However, by continuing the Examiner's above mentioned concept regarding the reference surface being the skull, a multitude of different distances from the skull must be being used in order to remove voxels in order to show the tumor surface within the skull. Therewith, the "second voxels", as understood by the Examiner, do not have one given fixed predefined distance from the reference surface as provided in claim 1 of the instant application. Accordingly, the "second voxels," as understood by the Examiner, do not correspond to the "second voxels," as described in claim 1 of the instant application.

In order to additionally reemphasize the features of claim 1: transferring the scenario in Figs. 1-3 to claim 1 would mean that the outer tumor surface is the reference surface and that the 2D images would illustrate inner layers of said tumor with the inner layers being parallel to the tumors surface.

Furthermore, the Examiner argues that the rendered second voxels displayed on the monitor as a two-dimensional image in Figs. 1-3 correspond to the visualized second voxels in a two-dimensional image as described in claim 1. Again, the Applicant kindly disagrees with the Examiner. As described on page 20 of Gering, the two-dimensional image in Figs. 1-3 is only a cross-section through volumetric 3D surface models. However, a cross-section through a 3D surface model does not analogous with the two-dimensional image formed by second voxels spaced the user-selected distance from the reference surface. In Figs. 1-3, a cross-section relates to a planar slice through a three-dimensional landscape. In contrast, in claim 1 of the instant application, the two-dimensional surface follows the surface structure of a reference surface, which, in a practical

example, means that said two-dimensional surface is an inner layer that is parallel to a reference (organ) surface. Accordingly, the inner layer is not planar, but shows the same roughness as the respective reference surface.

Because Gering does not teach the subject matter of claim 1, the subject matter of claim 1 is novel and involves steps not taught by Gering.

With respect to the primary reference, Gering, Gering in light of Gillick et al. '455 would not suggest to one with ordinary skill in the art the invention according to claim 1 because Gillick et al. '455 merely adds a computer mouse having a roller that implements a scrolling function for computer programs.

Therefore, claim 1 of the instant application is new and inventive over Gering, Gillick et al. '455 and Gering in view of Gillick et al. '455.

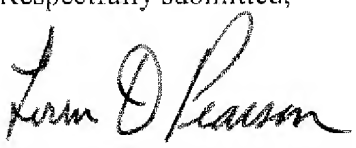
Because claim 8 describes a computer program product that is based on claim 1, the computer program product according to claim 8 is also new and inventive over Gering in view of Gillick et al. '455. The same argumentation holds for claim 10, which discloses a computer system for volume visualization that is based on claim 1. Moreover, because the claims 2-7, 9, and 11-18 depend on respective claims 1, 8, and 10, said claims 2-7, 9 and 11-18 are also patentable over Gering in view of Gillick et al. '455.

Conclusion

In light of the foregoing remarks, this application is now in condition for allowance and early passage of this case to issue is respectfully requested. If any questions remain regarding this response or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

No fee is believed due. However, please charge any required fee (or credit any overpayments of fees) to the Deposit Account of the undersigned, Account No. 500601 (Docket No. 7390-X04-030).

Respectfully submitted,



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